

PENAFLOO, JETHRO ISAAC P.

7ME-D

$$1) t_w = 25^\circ\text{C}$$

$$P_t = 101.4 \text{ kPa}$$

$$\phi = 50\%$$

$$h_{g1} = h_g @ 25^\circ\text{C} = 2547.2 \text{ kJ/kg}$$

$$a) P_s = P_{\text{sat}} @ 25^\circ\text{C} = 3.169 \text{ kPa} \text{ (Partial pressure of dry air)}$$

$$\phi = \frac{P_v}{P_{\text{sat}}} \Rightarrow P_v = (\phi)(P_{\text{sat}}) = (0.5)(3.169 \text{ kPa}) = 1.5845 \text{ kPa}$$

$$P_a = P_t - P_v = (101.4 - 1.5845) \text{ kPa} = \boxed{99.8155 \text{ kPa}}$$

$$b) \text{Dew Point Depression}$$

$$t_{dp} = t_{\text{sat}} @ P_v = 1.5845 \text{ kPa}$$

 $P_{\text{sat}}$ 
 $t_{\text{sat}}$ 

$$0.0014974$$

$$13$$

$$0.0015845$$

$$t_{dp}$$

$$0.0015083$$

$$14$$

$$\text{DPD} = t_w - t_{dp}$$

$$= (25 - 13.9)^\circ\text{C} = \boxed{11.1^\circ\text{C}}$$

$$t_{dp} = \frac{0.0015845 - 0.0014974}{0.0015083 - 0.0014974} (14 - 13) + 13$$

$$t_{dp} = 13.9^\circ\text{C}$$

$$c) \text{Specific Humidity}$$

$$W = \frac{0.622 P_v}{P_t - P_v} = \frac{0.622 (1.5845 \text{ kPa})}{(101.4 - 1.5845) \text{ kPa}} = 0.009883 \frac{\text{kg}}{\text{kg d.a.}}$$

$$0.009883 \frac{\text{kg}}{\text{kg d.a.}} \left( \frac{2.2406 \text{ lbm}}{1 \text{ kg}} \right) \left( \frac{7000 \text{ grains}}{1 \text{ lbm}} \right) = \boxed{69.18 \frac{\text{grains}}{\text{lbm d.a.}}}$$

$$d) \text{Degree of Saturation}$$

$$V = \phi \left( \frac{P_t - P_{\text{sat}}}{P_t - P_v} \right) = 0.5 \left( \frac{101.4 - 3.169}{101.4 - 1.5845} \right) = 0.49 \times 100\% = \boxed{49.2\%}$$

$$e) \text{Specific Volume}$$

$$v = \frac{0.28708 t_w}{P_t - P_v}$$

$$= \frac{0.28708 (25 + 273.15) \text{ K}}{(101.4 - 1.5845) \text{ kPa}}$$

$$v = \boxed{0.85 \frac{\text{m}^3}{\text{kg}}}$$

$$f) \text{Enthalpy}$$

$$h = 1.0622(t_w) + (W)(h_g @ t_w)$$

$$= (1.0622 \frac{\text{kJ}}{\text{kg d.a.}})(25^\circ\text{C}) + (0.009883 \frac{\text{kg}}{\text{kg d.a.}})(2547.2 \frac{\text{kJ}}{\text{kg}})$$

$$h = \boxed{50.3 \frac{\text{kJ}}{\text{kg d.a.}}}$$



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2)  $V_1 = 30 \text{ m}^3/\text{min}$

$t_{d2} = 21.1^\circ\text{C}$

$t_{d1} = 34^\circ\text{C}$

$t_{dp1} = 18^\circ\text{C}$

$P_0 = P_{\text{sat}} @ t_{d2} = 21.1^\circ\text{C} = 2.5028 \text{ kPa}$

$P_{\text{sat}}$

$t_{\text{sat}}$

$0.002487$

$21$

$P_s$

$21.1$

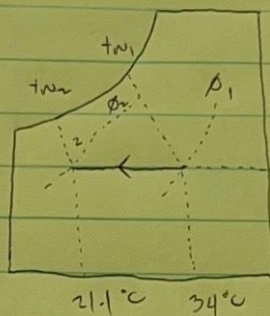
$0.002645$

$22$

a)  $P_{v1} = P_{\text{sat}} @ t_{dp1} = 18^\circ\text{C} = P_{v2}$   
 $= 2.064 \text{ kPa}$

$W_1 = \frac{0.622 P_v}{P_t - P_v} = \frac{0.622 (2.064 \text{ kPa})}{101.3 - 2.064 \text{ kPa}}$

$= 0.01293 \text{ kg/kg d.a.}$



$h_{g1} = h_g @ t_{d1} = 34^\circ\text{C} = 2563.5 \text{ kJ/kg}$

$h_{g2} = h_g @ t_{d2} = 21.1^\circ\text{C} = 2539.17 \text{ kJ/kg}$

$h_1 = 1.0062 (t_{d1}) + (W_1) (h_{g1})$

$= 1.0062 \frac{\text{kJ}}{\text{kg d.a.}} (34^\circ\text{C}) + 2563.5 \frac{\text{kJ}}{\text{kg}} (0.01293 \frac{\text{kg}}{\text{kg d.a.}})$

$h_1 = 67.35 \frac{\text{kJ}}{\text{kg d.a.}}$

$h_2 = 1.0062 (t_{d2}) + (h_{g2}) (W_2) = 1.0062 \frac{\text{kJ}}{\text{kg d.a.}} (21.1^\circ\text{C}) + (2539.17 \frac{\text{kJ}}{\text{kg}}) (0.01293 \frac{\text{kg}}{\text{kg d.a.}})$

$h_2 = 54.0623 \frac{\text{kJ}}{\text{kg d.a.}}$

$m = \frac{V_1}{V_1} = \frac{30 \text{ m}^3/\text{min}}{0.8883 \frac{\text{m}^3}{\text{kg}}}$

$m = 33.77 \text{ kg/min}$

$V_1 = \frac{0.28708 (t_{d1})}{P_t - P_{v1}} = \frac{0.28708 \frac{\text{kJ}}{\text{kg}} (34 + 273.15) \text{K}}{(101.325 - 2.064) \text{ kPa}}$

$V_1 = 0.8883 \text{ m}^3/\text{kg}$

$Q_2 = m (h_2 - h_1) = 33.77 \text{ kg/min} \left( \frac{1 \text{ min}}{60 \text{ s}} \right) (54.0623 - 67.35) \frac{\text{kJ}}{\text{kg d.a.}}$

$Q_2 = -7.48 \text{ kJ/s}$

b)  $\phi_2 = \frac{P_{v2}}{P_{s2}} = \frac{2.064}{2.5028} \times 100$

$\phi_2 = 82\%$

$$3) V = 0.5 \text{ m}^3/\text{s}$$

$$v_1 = 0.84 \text{ m}^3/\text{kg}$$

$$m = \frac{V_1}{v_1} = \frac{0.5 \text{ m}^3/\text{s}}{0.84 \text{ m}^3/\text{kg}}$$

$$m = 0.5952 \frac{\text{kg}}{\text{s}}$$

$$h_1 = 42 \text{ kJ/kg} \cdot \text{K}$$

$$h_2 = 59.5 \text{ kJ/kg} \cdot \text{K}$$

$$Q_A = m(h_2 - h_1) = 0.5952 \frac{\text{kg}}{\text{s}} (59.5 - 42) \text{ kJ/kg} \cdot \text{K}$$

$$Q_A = 10.42 \text{ kJ/s}$$

$$t_{dp} = 12.3^\circ\text{C}$$

